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NEW SPECIES OF *NEOMEGAMPHOPUS* FROM TROPICAL AMERICA (CRUSTACEA: MARINE AMPHIPODA)

J. L. Barnard and James Darwin Thomas

Abstract.—*Neomegamphopus hiatus* is described from Venezuela and the Florida Keys, *N. pachiatus* and *N. heardi* from Pacific Panama, and *N. kalanii* from eastern Florida. *Neomegamphopus hiatus* and *N. pachiatus* differ from a close congener, *N. roosevelti* (tropical eastern Pacific), in the much larger coxa 1 of mature males, the less setose gnathopods, and the broader carpus of the first gnathopod bearing a much deeper incision defining the posterior tooth; the carpus is much shorter and stouter in *N. hiatus* and *N. pachiatus* than in *N. roosevelti. Neomegamphopus heardi* differs from the other species in the bifid tooth on the carpus of gnathopod 1 in males. Questions regarding the reclassification of the Isaeidae, Aoridae, and Neomegamphopidae are explored and the three families amalgamated again to their status of 1973 (except Corophiidae which is segregated).

Four new species are added to the two species previously known in *Neomegamphopus* Shoemaker (1942). The enlarged coxa 1 of two of these species, *N. hiatus* and *N. pachiatus,* resembles that of *Konatopus* J. L. Barnard (1970) but we conclude they belong with *Neomegamphopus* because of the elongate propodus and extremely broadened and strongly toothed carpus of male gnathopod 1. The new species, *N. heardi,* differs from all other species in the genus in the bifid character of the tooth on the carpus of male gnathopod 1 (however, a similar undescribed species occurs in Venezuela for which insufficient material is available for description). *Neomegamphopus kalanii* may be a growth stage of *N. hiatus* but this stage is frequently larger than adults of *N. hiatus* and no stages of transformation between the two species can be demonstrated.

Neomegamphopus belongs to a group of genera placed in the family Neomegamphopidae by Myers (1981). We agree that such a family (or cluster of genera) can be loosely defined but not with the generic composition proposed by Myers (1981). He states (1981:9): "It is theoretically possible for a neomegamphopid to have a gnathopod 2 secondarily enlarged so as to dominate the primarily enlarged gnathopod 1. Such a neomegamphopid would in practice be difficult to distinguish from an isaeid." We believe that *Amphideutopus* J. L. Barnard (1959), classified by Myers as an Isaeid, is this organism. Continuing the quotation, "However, the axial gradient is so well established in isaeids that the females generally have gnathopod 2 larger than gnathopod 1 and thus indicate their origins. Neomegamphopidae, on the other hand, show little evidence of an axial gradient in the females." Myers continues: "The suggestion of multiple evolutionary reversal (Barnard, 1973) is rejected, and all corophioideans with protogammaropsis head structure . . . bearing complex male gnathopod 1 and primitive unmodified gnathopod 2 are placed in the family Neomegamphopidae. Isaeid genera such as *Amphideutopus* and *Ledoyerella* Myers (1973), whilst exhibiting an enlarged gnathopod 1 in males also possess an enlarged, complexly sub-

chelate gnathopod 2." We disagree and classify gnathopod 2 in these genera as ordinarily subchelate.

We disagree with this classification and the reasons for inclusion of several misplaced genera in various families cited by Myers (1981). Myers described or redescribed the families Corophiidae, Isaeidae, Aoridae, and Neomegamphopidae and follows the guidelines of the quotations cited above. For example, he creates the Neomegamphopidae with the type-genus being *Neomegamphopus,* which has a complexly subchelate gnathopod 1 quite in contrast to *Pseudomegamphopus* (1968c), one of the other genera he includes. Other genera are: *Konatopus, Varohios* J. L. Barnard (1979), and *Maragopsis* Myers (1973). *Varohios* has a very unusual male gnathopod 1 in which a dactyl and hand are present but no definitive carpus, the appendage having only 6 clear articles; one presumes articles 4 and 5 are fused. *Varohios* thus qualifies to be in the Neomegamphopidae based solely on the slightly enlarged female gnathopod 1 and not by the complexly subchelate gnathopod 1.

In contrast to the complex chelation of male gnathopod 1 in *Neomegamphopus,* Myers includes in the Isaeidae the genus *Amphideutopus* which also has a complexly subchelate gnathopod 1 but admittedly has a weakly enlarged female gnathopod 2, the primary character of Isaeidae. Gnathopod 2 of male *Amphideutopus* is as enlarged as gnathopod 2 but not complexly chelate. This qualifies *Amphideutopus* for inclusion in the Isaeidae according to Myers. *Acuminodeutopus* J. L. Barnard (1959), (=*Rudilemboides* J. L. Barnard [1959]), also with enlarged complexly subchelate gnathopod 1, on the other hand, is placed in the Aoridae where all genera are also characterized by poorly invaginated antenna 2. We consider the situation in *Acuminodeutopus* to be somewhat debatable as it is difficult to determine whether or not the genus belongs with those genera having deep or shallow invagination of antenna 2. For clarification, we present the following key to these families and include the Ischyroceridae, a companion family in the Corophioidea:

1. Pereonite 2 lacking coxal gill .... Corophiidae
– Pereonite 2 bearing coxal gills 2
2. Head not deeply recessed for insertion of antenna 2 ..... Aoridae
– Head deeply recessed for insertion of antenna 2 3
3. Female gnathopod 1 larger than gnathopod 2 .... Neomegamphopidae
– Female gnathopod 2 larger than gnathopod 1 4
4. Outer ramus of uropod 3 without spines, apex hooked ...Ischyroceridae
– Outer ramus of uropod 3 with spines, apex not hooked ..... Isaeidae

The Neomegamphopidae and Aoridae contain genera with male gnathopod 1 always enlarged, but Neomegamphopidae has two kinds of such gnathopod, complexly subchelate and ordinary (or "propodochelate" if such definition is desirable). The Aoridae seem to include three kinds of complexly subchelate gnathopod 1: propodochelate, carpochelate, merochelate, and noncomplex (ordinary). The Ischyroceridae have gnathopod 2 always larger than 1 but often complexly subchelate as in gnathopod 1 of Aoridae and Neomegamphopidae. As composed by Myers, the Isaeidae include males with carpochelate (*Amphideutopus*) and ordinary enlarged gnathopod 1 (*Aloiloi* J. L. Barnard [1970]) conjunct with males having small and female-like gnathopod 1. *Aloiloi* and *Amphideutopus* are included with Isaeidae because female gnathopod 2 is weakly enlarged (actually female of *Aloiloi* unknown). Hence, this classification divides carpochelate gnathopod 1 of males among Isaeidae, Neomegamphopidae, and Aoridae, retains merochelate gnathopod 1 of males in Aoridae where it is mixed with carpochelate and non-chelate genera, and places all carpochelate gnathopod 2 of males

in the Ischyroceridae (which was the conclusion of Barnard 1973). Examples of carpochelate gnathopod 2 in males are *Cerapus* and *Ericthonius.*

Primary difficulties with the above classification we believe are the disassociation of *Amphideutopus* from the Neomegamphopidae and the difficulty in determining the size relationships of female gnathopod 2 in a few genera and a few species of certain other genera. For example, in the new species of *Neomegamphopus* described herein, female gnathopod 1 should be larger than gnathopod 2 by familial definition but is not and instead is identical to gnathopod 1. Other examples are: *Neomegamphopus kunduchii* Myers (1973), *Konatopus latipalma* Ledoyer (1979), and *Varohios topianus* J. L. Barnard (1979). Examples of the alternative case, in which female gnathopod 2 should be larger than gnathopod 1 occur in *Amphideutopus oculatus* J. L. Barnard (1959) where the condition is debatable; female gnathopod 2 has a longer propodus than gnathopod 1 and probably the total facial area of articles 5–6 is greater than on gnathopod 2. Classification is very difficult when value judgments are so vagarious as in these examples.

The depth of insertion below the head of antenna 2 is very difficult to decide in several crucial genera, such as *Acuminodeutopus* and *Rudilemboides,* etc. We believe that *Amphideutopus* should be in the same family as *Neomegamphopus* even though male gnathopod 2 is secondarily enlarged; it however is not carpochelate but simply a thickened version of the common kind of gnathopod found in species of the Neomegamphopidae. Owing to the completely distinctive gnathopod 1, we do not believe that *Pseudomegamphopus* and *Varohios* have very close affinities to *Neomegamphopus* in the Neomegamphopidae.

In its broad propodus, *Maragopsis* differs from the complexly subchelate kind of gnathopod 1 typical of *Neomegamphopus*; all other genera have a thin simple propodus; *Maragopsis* has almost no tooth on the carpus (thus not carpochelate) but as we have already placed *Rudilemboides* with Neomegamphopidae, *Maragopsis* could not be excepted.

We also believe that *Rudilemboides* can be separated from *Acuminodeutopus* as based on the following key; *Pseudomegamphopus, Maragopsis* and *Varohios* are removed from the key.

Key to the Neomegamphopid Genera

1. Hand of male gnathopod 1 as broad as carpus ..... *Maragopsis*
– Hand of male gnathopod 1 much thinner than carpus 2
2. Article 3 of mandibular palp thickly clavate, with numerous inner setae 3
– Article 3 of mandibular palp thin, poorly setose 5
3. Male gnathopod 2 enlarged ..... *Amphideutopus*
– Male gnathopod 2 not enlarged .. 4
4. Propodus of male gnathopod 1 elongate, coxa 1 only 120 percent as long (axial) as coxa 2 ... *Neomegamphopus*
– Propodus of gnathopod 1 short, coxa 1 more than 160 percent as long (axial) as coxa 2 ..... *Konatopus*
5. Inner ramus of uropod 3 elongate, male gnathopod 1 not carpochelate ..... *Rudilemboides*
– Inner ramus of uropod 3 short, male gnathopod 1 carpochelate ..... *Acuminodeutopus*

Owing to the difficulties in making value judgements about the two primary categories of character that separate Aoridae, Isaeidae, and Neomegamphopidae from each other, we continue to consider the three groups as indivisible until some better way to develop subdivisions can be found. We agree with Bousfield (1973) that the four genera split away in the Corophiidae can be retained in that family as based on absence of coxal gill 2 until transitional genera are found. This would result in the Aoridae and

Neomegamphopidae being recombined under the name Isaeidae until some clear subdivision can be established. We must note, however, that differential loss of coxal gills in Podoceridae is not useful as a family character.

In order to ameliorate the confusion about the position of *Neomegamphopus* we present the following key which includes all genera from Aoridae, Neomegamphopidae, and Isaeidae which have a carpochelate male gnathopod 1 or which have the carpus of male gnathopod 1 dominating the propodus in terms of size or lateral surface area; thus *Maragopsis, Lemboides* Stebbing (1895), and *Rudilemboides* are included as based on the second definition.

Key to the Carpochelate or Dominant-Carpus Genera

1. Mandibular palp article 3 falcate 2
– Mandibular palp article 3 not falcate 3
2. Carpus of gnathopod 1 with tooth ..... *Microdeutopus*
– Carpus of gnathopod 1 lacking tooth ..... *Lemboides*
3. Coxae slightly disjunct, inner ramus of uropod 3 absent 4
– Coxae not disjunct, inner ramus of uropod 3 present 5
4. Uropod 2 biramous .. *Grandidierella*
– Uropod 2 uniramous ... *Chevreuxius*
5. Article 3 of mandibular palp stout and bearing medial setae 6
– Article 3 of mandibular palp slender and lacking medial setae 9
6. Propodus of male gnathopod 1 broad ..... *Maragopsis*
– Propodus of male gnathopod 1 thin 7
7. Article 2 of male gnathopod 1 thick ..... *Konatopus*
– Article 2 of male gnathopod 1 slender 8
8. Male gnathopod 2 thin .... *Neomegamphopus*
– Male gnathopod 2 enlarged and broadened ..... *Amphideutopus*
9. Male gnathopod 2 broad *Zoedutopus*
– Male gnathopod 2 slender 10
10. Inner ramus of uropod 3 shortened, carpus of male gnathopod 1 with tooth ..... *Acuminodeutopus*
– Inner ramus of uropod 3 not shortened, carpus of male gnathopod 1 without tooth ..... *Rudilemboides*

In the above key one would assume from Myers' (1981) comments that there is a large degree of homology among the genera; he believes that axial reversal of gnathopods proposed by Barnard (1973) is to be rejected and one would therefore suppose that the carpochelate shape of the gnathopod has not arisen independently in each genus. This does not necessarily negate our opinion that axial reversal (dominance by gnathopod 1) has not occurred several times in the Isaeidae sensu lato because different kinds of first gnathopods are present in the amalgamated group.

Master Legend

Capital letters as follows refer to parts; lower case letters to left of capital letters refer to specimens noted in legends; lower case letters to right of capitals refer to adjectival modifications in list below:

B, body; D, dactyl; F, accessory flagellum; G, gnathopod; H, head; J, lacinia mobilis; K, palm of gnathopod 2; L, labium; M, mandible; N, molar; O, outer plate or ramus; P, pereopod; R, uropod; S, maxilliped; T, telson; U, labrum; V, palp; W, urosome; X, maxilla; Y, oostegite; Z, gill; r, right; s, setae removed; t, left.

Neomegamphopus Shoemaker

Neomegamphopus Shoemaker, 1942:35 (*Neomegamphopus roosevelti* Shoemaker, 1942, original designation).

Diagnosis.—Article 3 of mandibular palp thick and clavate, well setose on inner mar-

gin; coxa 1 longer axially than coxa 2; male gnathopod 1 carpochelate, propodus elongate; female gnathopod 1 usually larger than gnathopod 2; rami of uropod 3 subequal.

Notes on Problems

There are problems with length of accessory flagellum in this genus which we have not resolved. In species with robust males such as *N. roosevelti* the accessory flagellum is half as long as article 1 of the primary flagellum; because the latter article is elongate in robust species the accessory flagellum is relatvely short; however in taxa such as *Neomegamphopus* species C, both article 1 of the primary flagellum and the accessory flagellum are short and the accessory flagellum is half as long as the primary article. In dwarf species such as *N. hiatus* the accessory flagellum is as long as or longer than article 2 of the primary flagellum, but these adults apparently do not enlarge and undergo articular elongation of the primary flagellum as typical of *N. roosevelti*. There may be a good taxonomic difference between species based on this kind of character, but owing to the loss of antennae in most preserved specimens it becomes a poor identifying character and we cannot resolve the problem without better material.

We are constrained from describing females of our new species because their mixture in generalized samples is confusing.

Key to the Adult Males of *Neomegamphopus*

1. Tooth on carpus of male gnathopod 1 directly terminal ..... *kunduchii*
– Tooth on carpus of male gnathopod 1 separated from body of article by large excavation 2
2. Carpal process of gnathopod 1 bifid 3
– Carpal process of gnathopod 1 simple 4
3. Gnathopod 2 simple, accessory flagellum half as long as article 1 on primary flagellum .... sp. C (Coche, Venezuela)
– Gnathopod 2 subchelate, accessory flagellum as long as article 1 on primary flagellum ..... *heardi*
4. Gnathopod 2 simple, article 6 of gnathopod 1 with well defined proximal hump ..... *roosevelti*
– Gnathopod 2 subchelate, article 6 of gnathopod 1 with weak proximal expansion or none 5
5. Carpus of gnathopod 2 with 8+ anterior setae ..... *pachiatus*
– Carpus of gnathopod 2 lacking significant anterior setae 6
6. Carpus of gnathopod 1 about 0.8 times as wide as long, palm not beaded, tooth gaping ..... *hiatus*
– Carpus of gnathopod 1 about 0.6 times as wide as long, palm beaded, tooth not gaping ..... *kalanii*

Neomegamphopus roosevelti Shoemaker
Fig. 4, lower left

Neomegamphopus roosevelti Shoemaker, 1942:36–38, fig. 13.—J. L. Barnard, 1962: 10; 1969a:92, figs. 5–6; 1969b:192. not Myers, 1968a:505, figs. 5a–c, f; 1968b: 127–128, fig. 1.

Diagnosis.—Accessory flagellum half as long as article 1 of primary flagellum; coxa 1 about 1.25 times as long as coxa 2; carpus of male gnathopod 1 about 0.5 times as wide as long, simple tooth separated from body of article by incision 0.3 times as long as tooth, propodus about 0.4 times as wide as long, setose anteriorly, with strongly defined proximal lobe; gnathopod 2 simple, carpus strongly setose anteriorly, about 1.7 times as long as propodus.

Remarks.—We have examined the voluminous original material of this species described from Magdalena Bay, Baja California.

Young males of size approximating ju-

veniles and adults of the dwarf species we describe herein have well setose anterior margins on the carpus of gnathopod 2. We believe this demonstrates a useful means to separate young males of the varous species from *N. roosevelti,* although we have no proof that young males of the dwarf species do not have a stage with well setose carpi. We have one young male "p" 1.52 mm in sample 114 from Bahia Honda, Panama, that has eight anterior setae on the carpus of gnathopod 2 and has the undifferentiated kind of gnathopod 1 typical of adult *N. roosevelti* and smallest juveniles of dwarf species; we therefore identify male "p" as possible *N. roosevelti*; this results in sample 114 containing three species of the genus, *N. roosevelti, N. heardi,* and *N. pachiatus*; however the sample is a generalized collection and probably overlapped several habitats.

Youngest males of *N. roosevelti* in the original Magdalena Bay material have palmar denticles on gnathopod 2 but in larger males these become so absorbed into the palm that they appear only faintly; of course, the palm is obsolescent in *N. roosevelti* (and *Neomegamphopus* sp. C. from Coche Island, Venezuela). These denticles are sufficiently large in males of dwarf species *N. pachiatus, N. hiatus,* and *N. heardi* to show clearly on medium power (40×) microscopy.

The juvenile male "n" 1.63 mm from Magdalena Bay has 19 anterior carpal setae on gnathopod 2.

Material.—Pacific, Baja California, Magdalena Bay no. 3, inside north entrance to bay between Blecker Pt. and anchorage, 10–15 fms, sandy weedy bottom, 18 Jul 1938, coll. Waldo L. Schmitt, juvenile male "n" 1.63 mm; Magdalena Bay no. 4, from deeper end of preceding dredge hauls, filamentous green algae, 18 Jul 1938, Waldo L. Schmitt, males "v," "x," "y," "z," and young male "w" 2.76 mm.

Distribution.—Corona del Mar, California to Bahía Honda, Panama, 0–42 m.

Neomegamphopus hiatus, new species
Figs. 1–3, 4 lower right

Diagnosis.—Accessory flagellum longer than article 1 of primary flagellum; coxa 1 about 1.6 times as long (axial) as coxa 2; carpus of adult male gnathopod 1 about 0.8 times as wide as long, simple tooth not directly terminally but separated from body of article by incision 0.60 times as long as tooth, propodus naked anteriorly, about 0.35 times as wide as long, not expanded or lobate proximally; gnathopod 2 subchelate, carpus almost naked anteriorly, about 1.10 times as long as propodus.

Description of male holotype "a" 2.27 mm.—As in illustrations; ocular lobe with weak apical flange, anteroventral corner of head with weak cusp; eyes orange-brown, clear of dense pigment in life and in preservative. Epistome not produced, upper lip weakly incised below. Right lacinia mobilis with 3 principal teeth, left with 4 teeth, molar lacking seta. Outer plate of maxilla 1 with 9 spines. Inner plate of maxilliped with 3 stout biserrate spines, apex of dactyl with 2 large and one small seta.

Article 2 of gnathopod 1 with anterior groove for reception of anterior margin of carpus. Palm of gnathopod 2 defined by small spine. Pereopods 3–7 each with 2 locking spines. Gills present on coxae 2–6.

Epimera 1–3 each with small notch and tooth on posteroventral margin, posterior margins strongly convex, exaggerated on epimeron 3. Uropod 1 with interramal tooth on peduncle, absent on uropod 2. Outer ramus of uropod 3 slightly shorter than inner, with tiny barrel-shaped article 2 bearing long seta, apex of inner ramus with stout spine. Telson with dorsoposterior bevel or excavation, each lateral apex with 2 small teeth, one thick spine, one long seta, one short penicillate setule.

Female "c" 2.16 mm.—Coxa 1 not longer than coxa 2; gnathopod 1 reduced and similar to male and female gnathopod 2 but very slightly larger than female gnathopod

Fig. 1. *Neomegamphopus hiatus,* unattributed figures, male "a"; c = female "c."

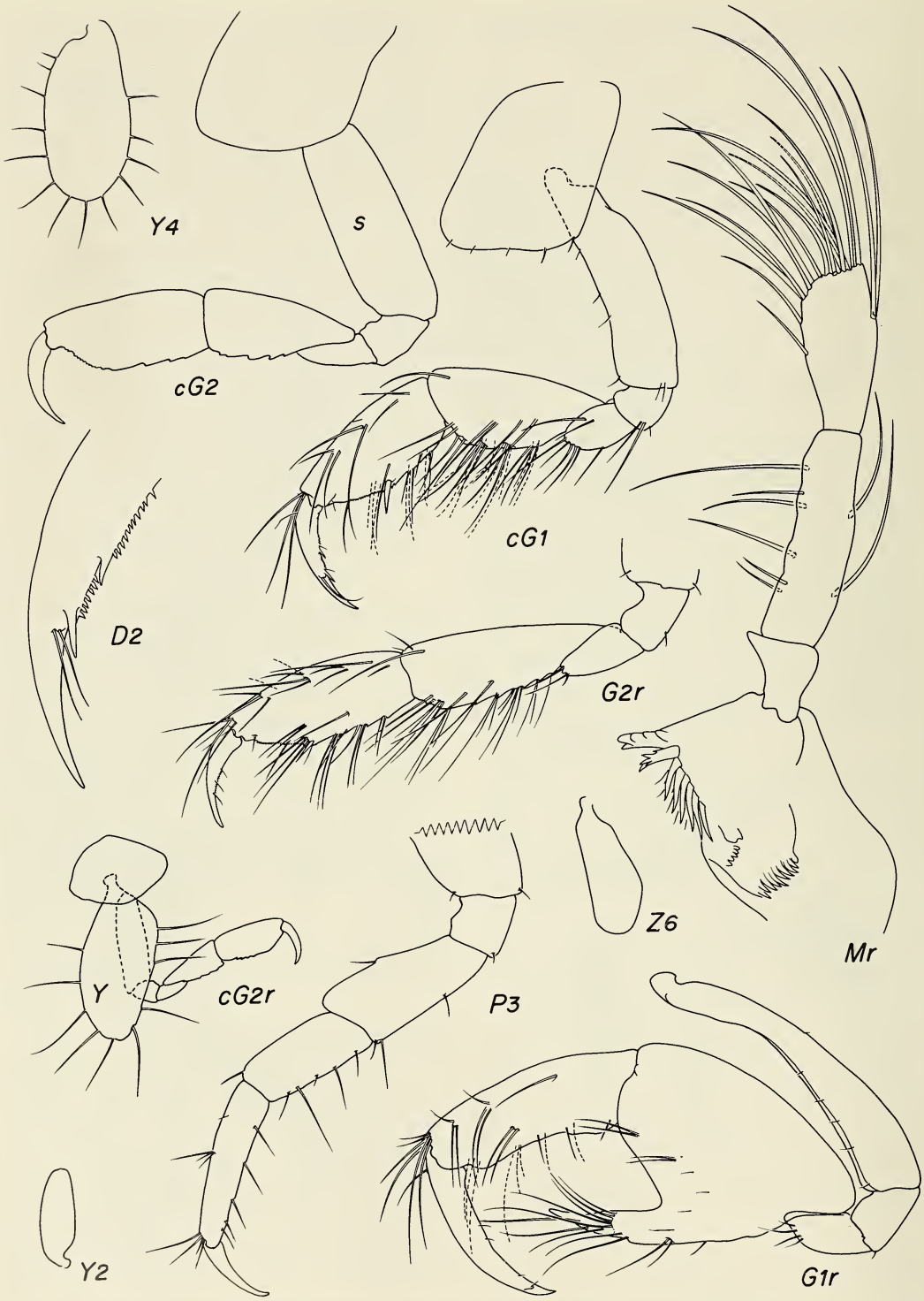

Fig. 2. *Neomegamphopus hiatus,* unattributed figures, male "a"; c = female "c."

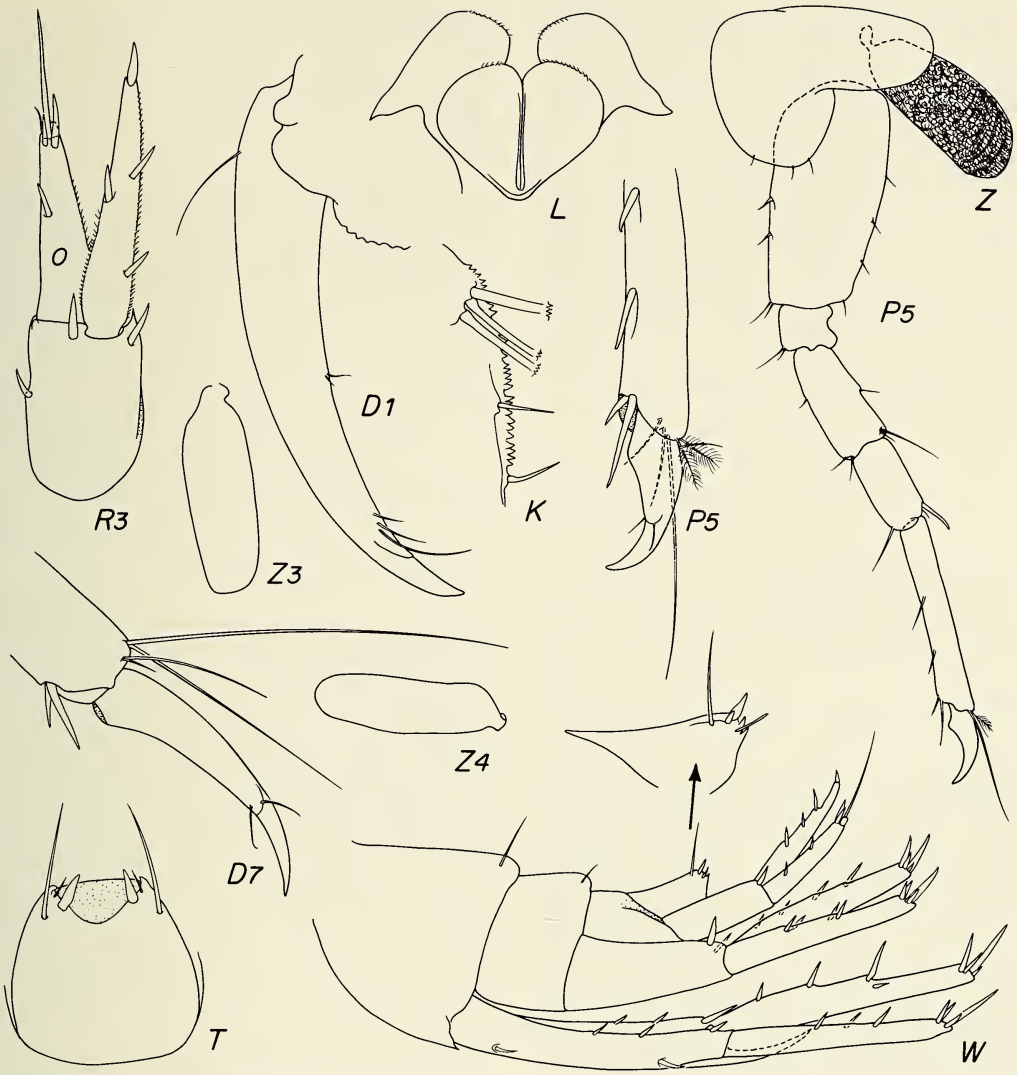

Fig. 3. *Neomegamphopus hiatus,* male "a."

2. Oostegites moderately broad, on coxae 2–5.

Illustration.—Following parts not enlarged, visible on body drawing: head, antennae, accessory flagellum, coxae, pereopods 4, 6, 7. Maxilla 2 much larger than maxilla 1, thus magnification of maxilla 2 strongly reduced relative to maxilla 1 in our illustrations.

Etymology.—Hiatus, (L.) = "gap." a noun in apposition, in reference to gaping tooth on gnathopod 1.

Holotype.—USNM No. 195143, male "a" 2.27 mm.

Type locality.—Venezuela, Islas Los Roques, 11°55′N, 66°40′W, in *Thalassia* bed on *Halimeda* rubble with small percentage of sand-silt sized particles, 0.8–1.0 m, temperature 27.5°, salinity 37 ppt, coll. Alan W. Stoner, 1 May 1980.

Material.—Type locality, female "c" 2.16 mm, female "d" 1.67 mm, male "e" 2.56 mm (total 15 specimens).—Florida Keys, Looe Key, LKFR-1B, forereef, wash of coral

and coral rubble chipped from overhangs, 8 m, coll. J. D. Thomas, 18 Apr 1982 (25 specimens).—Kalani Cairns Harbor Branch Foundation Station 916, off Fort Pierce, Florida, 27°33.2′N, 80°02.8′W, 33 m, 0.1 m^2 Smith-MacIntyre grab, 26 Apr 1977, male "e," unmeasured; vial 2, same area, male "L" 3.18 mm, male "M" 2.78 MM, male "q" unmeasured.—Moody Canal, Biscayne Bay, Florida, 1.5 m, mixed *Syringodium* and *Thalassia,* 3 Apr 1982, coll. J. D. Thomas (7 specimens).—Off Jacksonville, Florida, 30°41′N, 80°16′W, 23 fms, 10 Mar 1986, coll. Bowers (1 specimen).—Dry Tortugas, Loggerhead Key, in broken rocks, 26 Jun 1931, coll. Waldo L. Schmitt (1 specimen).—US *Albatross* 2372, Gulf of Mexico, 29°15′30″N, 85°29′30″W, 27 fms, 7 Feb 1885 (4 specimens).

Distribution.—Venezuela to Jacksonville, Florida, 0.8–49 m.

Neomegamphopus kalanii, new species
Fig. 6, lower

Diagnosis.—Accessory flagellum as long as first article of primary flagellum; coxa 1 about 1.5 times as long as coxa 2; carpus of male gnathopod 1 about 0.60 times as wide as long, single tooth separated from body of article by incision about 0.25 times as deep as length of tooth, propodus naked anteriorly, about 0.43 times as wide as long, expanded proximally; gnathopod 2 well subchelate, carpus with 4 anterior setae, about 0.93 times as long as propodus.

Description of male holotype "r" 2.99 mm.—As in illustrations; parts not illustrated generally like *N. hiatus* except as mentioned; ocular lobe with weak apical flange, anteroventral corner of head with weak cusp; eyes with deep orange pigment in alcohol (specimens recently preserved in alcohol). Epistome weakly lobate in front of upper lip, latter with small ventral notch. Right incisor with 6 teeth, lacinia mobilis bifid, large third tooth present in crotch, rakers 6, molar lacking seta (?no socket found), palp article 2 with 2 dorsal and 5 ventral setae, article 3 with 2 A setae, 1 C seta, 2 D setae, 5 E setae; (left mandible lost). Mandibular lobes of lower lip moderately extended, tapering sharply (illustrated).

Inner plate of maxilla 1 with 5 setae (illustrated), outer plate with 10 spines on both sides, apex of palp with 4 forked spines (not as strongly as in *N. roosevelti* and other species described herein), one serrate spine and 4 setae in oblique row (illustrated). Inner plate of maxilla 2 with 18 facial setae in oblique row. Maxillipeds like *N. hiatus,* inner plate with 3 spines, 7 apicofacial setae, 6 medial setae, outer plate with 6 apicalmedial spines, 2 apical setae, 5 pairs of ventral setae, palp moderately setose, dactyl with thick spine and 4 setae.

Article 2 of gnathopod 1 bearing weak anterior groove for reception of carpus. Palm of gnathopod 2 defined by stout spine. Coxae 3–7 generally like *N. hiatus* but those and pereopods more strongly armed; for example, article 2 of pereopods 5–7 with 11 posterior setules, some of these thickened and spine-like; pereopods 3–4 very slender (see illustration, apparently abnormal, see other specimens to follow), smallest locking spine on pereopod 5 only half as long as partner, about two thirds as long on pereopod 7 (this also probably abnormal); pereopod 4 scarcely smaller than 3. Gill 7 vestigial.

Epimera and uropods generally as in *N. hiatus* but spine counts greater: on lateral peduncles of uropods 1–3 = 5-1-1, other spines variable, spines on outer rami of uropod 1 left and right = 2 + 1 and 3 + 2, inner rami = 2 + 5 and 0 + 2; outer rami of uropod 2 = 1 + 0 and 3 + 2, inner rami = 1 + 2 and 2 + 5; outer rami of uropod 3 = 1 + 1, inner rami = 0 + 2 and 1 + 2; ventrolateral face of peduncle on uropod 1 with 2 spines (abnormally reduced to 1 seta on left).

Male "g" 2.78 mm.—Right and left incisors with 7 teeth, right lacinia mobilis bifid, lacking third tooth, rakers right and left =

5 and 6, right molar with seta, right palp article 2 with 3 dorsal and 8 ventral setae, setae on article 3 = 4 + 1 A, 2 C, 2 D, 10 E. Peduncle of uropod 1 with 5 lateral spines, formulas on outer and inner rami of uropod 1 = 2 + 1 and ?1 + 2, uropod 2 = 2 + 2 and 1 + 2, uropod 3 = 1 + 0 and 0 + 2; peduncle of uropod 1 with 3 ventrofacial spines. Articles 4–6 of pereopods 3–4 of ordinary breadth as in other species described herein.

Male "j" 2.48 mm and male "f" 2.27 mm.—Propodus of gnathopod 1 lacking beads on posterior margin; otherwise with weak basal swelling on carpal tooth.

Etymology.—Named for Kalani Cairns, Esq., who has helped us greatly with amphipod problems in Florida.

Holotype.—USNM No. 195155, male "r" 2.99 mm.

Type locality.—Kalani Cairns Sample XI-8, Harbor Branch Foundation, off Fort Pierce, Florida, 27°28.86′N, 79°56.40′W, 124 m, recolonization tray, 1 Oct 1980.

Material.—Cairns Harbor Branch Stations 916, off Fort Pierce, 27°33.2′N, 80°02.8′W, 33 m, grab, 26 Apr 1977, male "f" 2.27 mm, male "g" 2.78 mm.—Station 915, same data as 916, duplicate sample, male "j" 2.48 mm, female "h" unmeasured.—Station XVI, off Fort Pierce, 27°33.09′N, 80°03.06′W, 33 m, recolonization tray, 16 Apr 1982, male "k" 2.65 mm. Vial 2, same data as XVI, male "q" unmeasured.

Relationship.—At first we believed specimens of this species might be untransformed juveniles of *N. hiatus* but because the largest are larger and better armed than transformed males of *N. hiatus* we looked more closely at them. The propodus of gnathopod 1 has large serration-beads on the posterior margin. The basal swelling of the carpal tooth does not appear in adults of *N. hiatus*. The holotype is clearly much better developed than *N. hiatus* in view of the presence of five setae on the inner plate of maxilla 1, the maxillary palps are better armed (but the spines are less strongly bifid than in other species), the facial row of setae on maxilla 2 is very strong and the outer plate of the maxilliped is very well developed. However, the holotype is aberrant in the extremely slender pereopods 3–4 compared to other specimens of this species and with specimens of other species. Right and left uropodal spine counts are asymmetric but more uniform in male "g."

Distribution.—East coast of Florida, 33 m.

Neomegamphopus pachiatus, new species
Fig. 4, upper

Neomegamphopus roosevelti.—Myers, 1968a:505, fig. 5f.

Diagnosis.—Accessory flagellum [as long as article 1 of primary flagellum in specimen other than holotype, this information missing in holotype]; coxa 1 nearly 1.4 times as long as coxa 2; carpus of male gnathopod 1 about 0.8 times as wide as long, tooth separated from body of article by incision 0.50 times as long as tooth, propodus naked anteriorly, about 0.25 times as wide as long, neither expanded nor lobate proximally; gnathopod 2 subchelate, carpus moderately setose anteriorly, about 1.35 times as long as propodus.

Description of male holotype "b" 2.04 mm.—As in illustrations and parts not illustrated generally like *N. hiatus* except as mentioned; antennae 1–2 and pereopods 3, 4, 6 missing; ocular lobe with weak apical flange, anteroventral corner of head with weak cusp; eyes clear in alcohol (specimens 52 years old). Epistome not produced, upper lip weakly truncate below. Right incisor with 4 teeth, lacinia mobilis bifid, third tooth obsolescent, rakers 5, molar with one long seta, palp article 2 with 8 setae, article 3 with 3 A setae, 2 D setae, 7 E setae; left incisor with 4 teeth, lacinia mobilis with 4 teeth, rakers 5, molar lacking seta. Mandibular lobe of lower lip sharp and curled (distinct from *N. hiatus*).

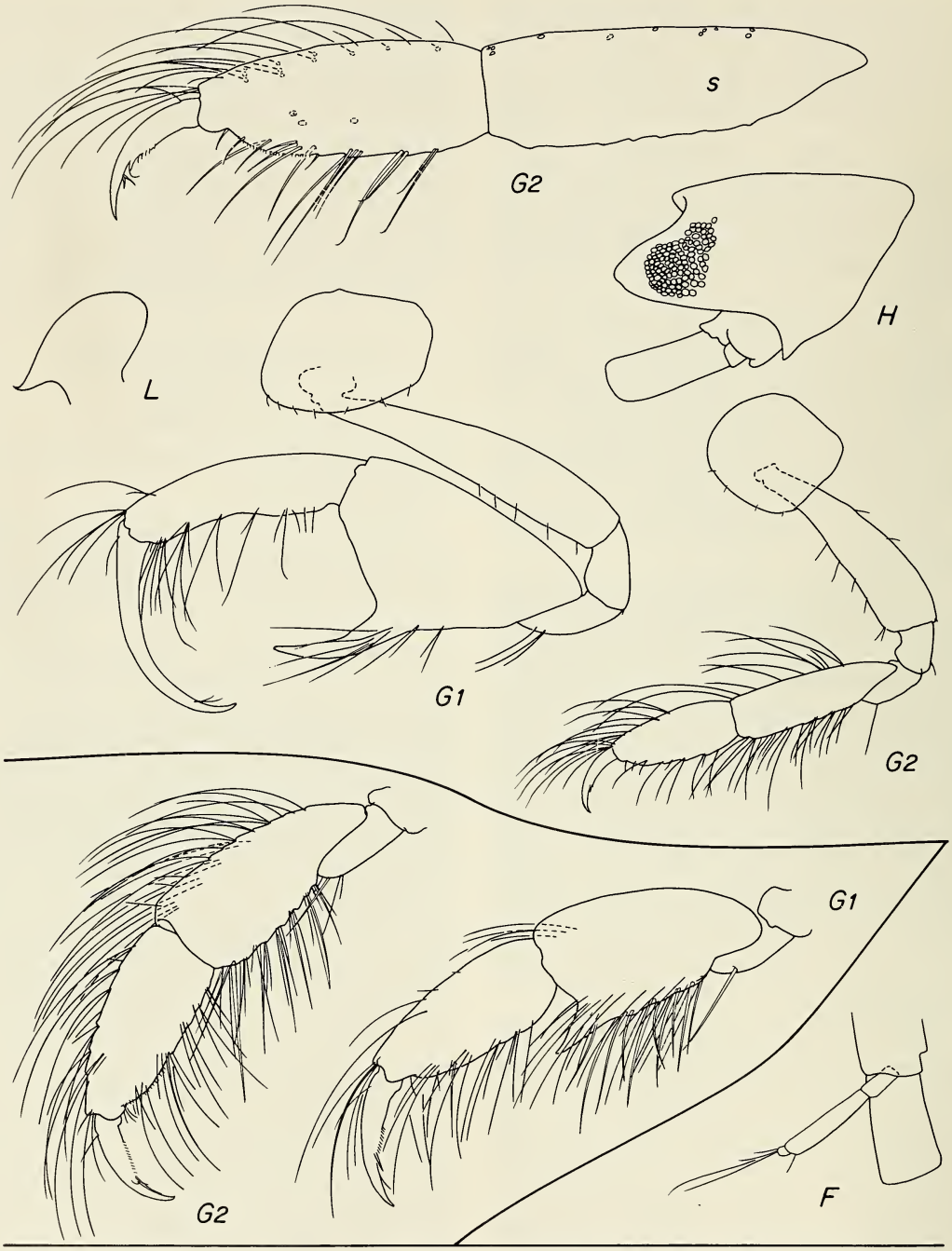

Fig. 4. Upper, *Neomegamphopus pachiatus,* holotype male "b" 2.04 mm. Lower left, *N. roosevelti,* juvenile male "n," 1.63 mm. Lower right, *N. hiatus,* male "l" 3.18 mm.

Inner plate of maxilla 1 with 1 seta, outer with 10 spines on both sides, apex of palp with 3 forked spines, one serrate spine, and 2 setae (scarcely in axial tandem). Inner plate of maxilla 2 with well developed facial row of 10+ setae. Maxilliped like *N. hiatus* but outer plate more slender, apical and medial spines reduced to 4, apical setae reduced to 2, ventral face with 3 pairs of setae; setae of palp sparser, dactyl with 4 setae.

Article 2 of gnathopod 1 lacking anterior groove for reception of carpus. Palm of gnathopod 2 defined by very slender spine. Coxae 3–7 like *N. hiatus*. Pereopods 5 and 7 like *N. hiatus* but setae sparser, article 2 on pereopod 5 with 7 posterior setules (thus more).

Epimera and uropods generally as in *N. hiatus*; spine counts on lateral peduncles of uropods 1–3 = 2-1-1; lateral and medial spine counts (not apical) on rami of uropods 1–2 = 1 + 0, 2 + 1, on inner rami = 0 + 1, 1 + 3; spines on outer and inner rami of uropod 3 = 1 and 1; ventrolateral face of peduncle on uropod 1 with 2 spines.

Etymology.—Pacific congener of *hiatus* (pac + hiatus).

Holotype.—USNM 195151 (but transferred to Allan Hancock Foundation as rightful owner), male "b" 2.04 mm.

Type locality.—*Velero III* station 114-33, Bahia Honda, Panama, near east point, 2 fms, 10 Mar 1933.

Material.—The type locality, 17 males.

Relationship.—This species is very close to *N. hiatus* from the Caribbean Sea but establishment of a species is justified on recent works by several taxonomists who have split Pacific and Atlantic sibling species in Phoxocephalidae and Ampeliscidae on very minor characters.

Neomegamphopus pachiatus differs from *N. hiatus* in the narrower article 6 of gnathopod 1, the greater length of and the presence of significant numbers of anterior setae on the carpus of gnathopod 2, and the shorter coxa 1.

Distribution.—Pacific Panama, 4 m.

Neomegamphopus heardi, new species
Figs. 5, 6 upper

Neomegamphopus roosevelti.—Myers, 1968a:505, figs. 5a, b.

Diagnosis.—Accessory flagellum as long as article 1 of primary flagellum; coxa 1 about 1.4 times as long as coxa 2; carpus of male gnathopod 1 about 0.65 times as wide as long, with 2 teeth at apex not separated by incision from body of article, inner tooth weakly palmate, separated from dominant tooth by incision one-third as long as dominant tooth, propodus anteriorly setose, about 0.6 times as wide as long, expanded proximally; gnathopod 2 well subchelate, carpus poorly or not setose anteriorly, almost 1.3 times as long as propodus.

Description of male holotype "c" 1.99 mm.—As in illustrations; parts not illustrated generally like *N. hiatus* except as mentioned; pereopod 5 missing, coxa 5 like *N. hiatus*; ocular lobe with weak apical flange, anteroventral corner of head with weak cusp; eyes clear in alcohol (specimens 52 years old). Epistome not produced, upper lip weakly truncate below. Right incisor with 5 teeth, lacinia mobilis bifid, third tooth absent, rakers 4, molar with one long seta, palp article 2 with 9 ventral and 4 dorsal setae (inner and outer respectively). Article 3 with 2 A setae, 2 C setae, 1–2 D setae and 9+ E setae; left incisor with 4 teeth, lacinia mobilis with 4 teeth, rakers 5, molar lacking seta. Mandibular lobes of lower lip long, slender, sharp uncurled.

Inner plate of maxilla 1 with 1 seta, outer plate with 10 spines on both sides, apex of palp with 3 forked spines, one serrate spine and 2 setae in axial tandem. Inner plate of maxilla 2 with well developed facial row of 10 setae. Maxilliped like *N. hiatus* but inner plate with 2 apical spines, 2 medial setae and 5 apicofacial setae, outer plate with 5 medial and apical spines and 1–2 apical setae, palp moderately setose, dactyl with 3 setae.

Article 2 of gnathopod 2 with anterior

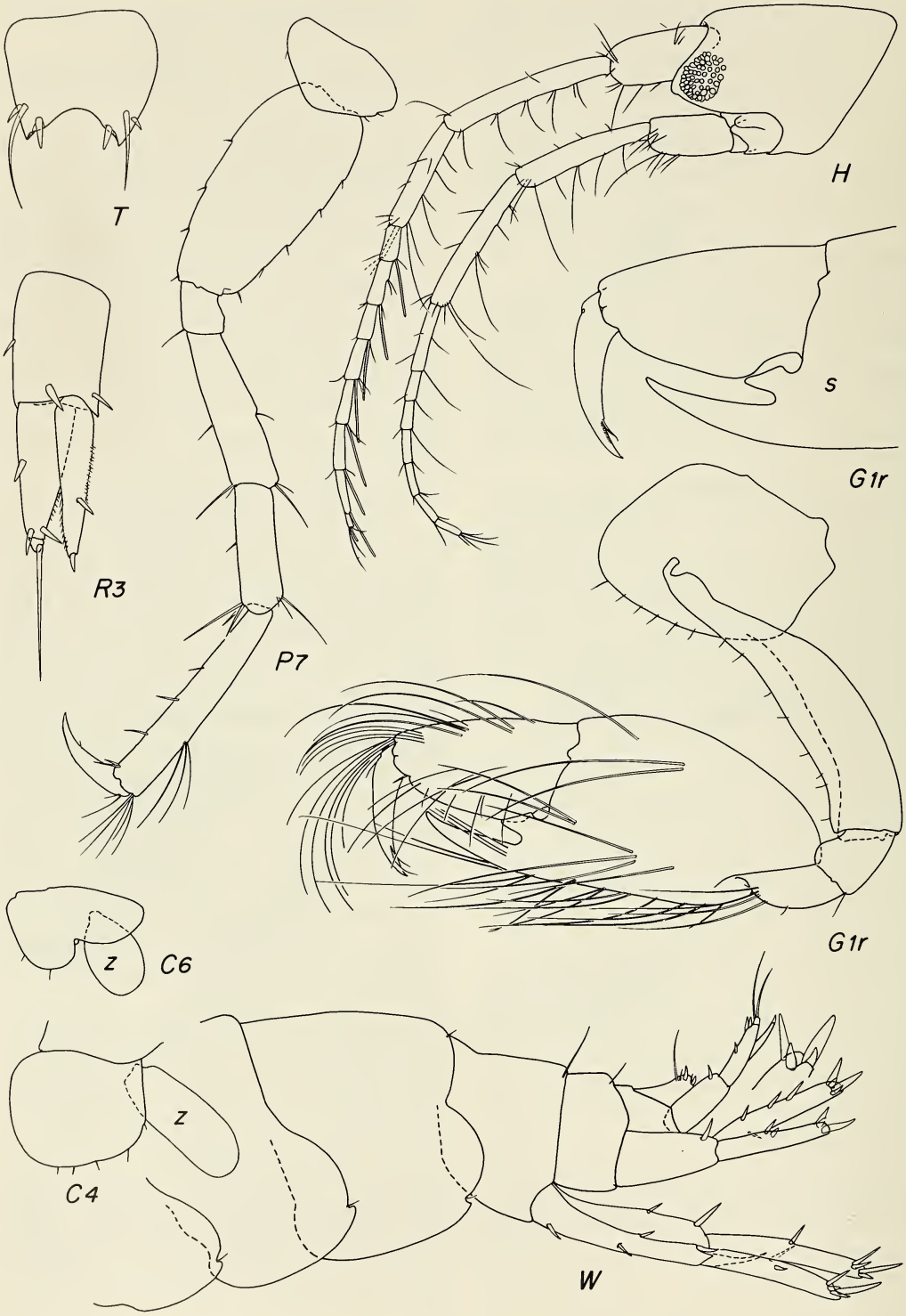

Fig. 5. *Neomegamphopus heardi*, holotype male "c" 1.99 mm.

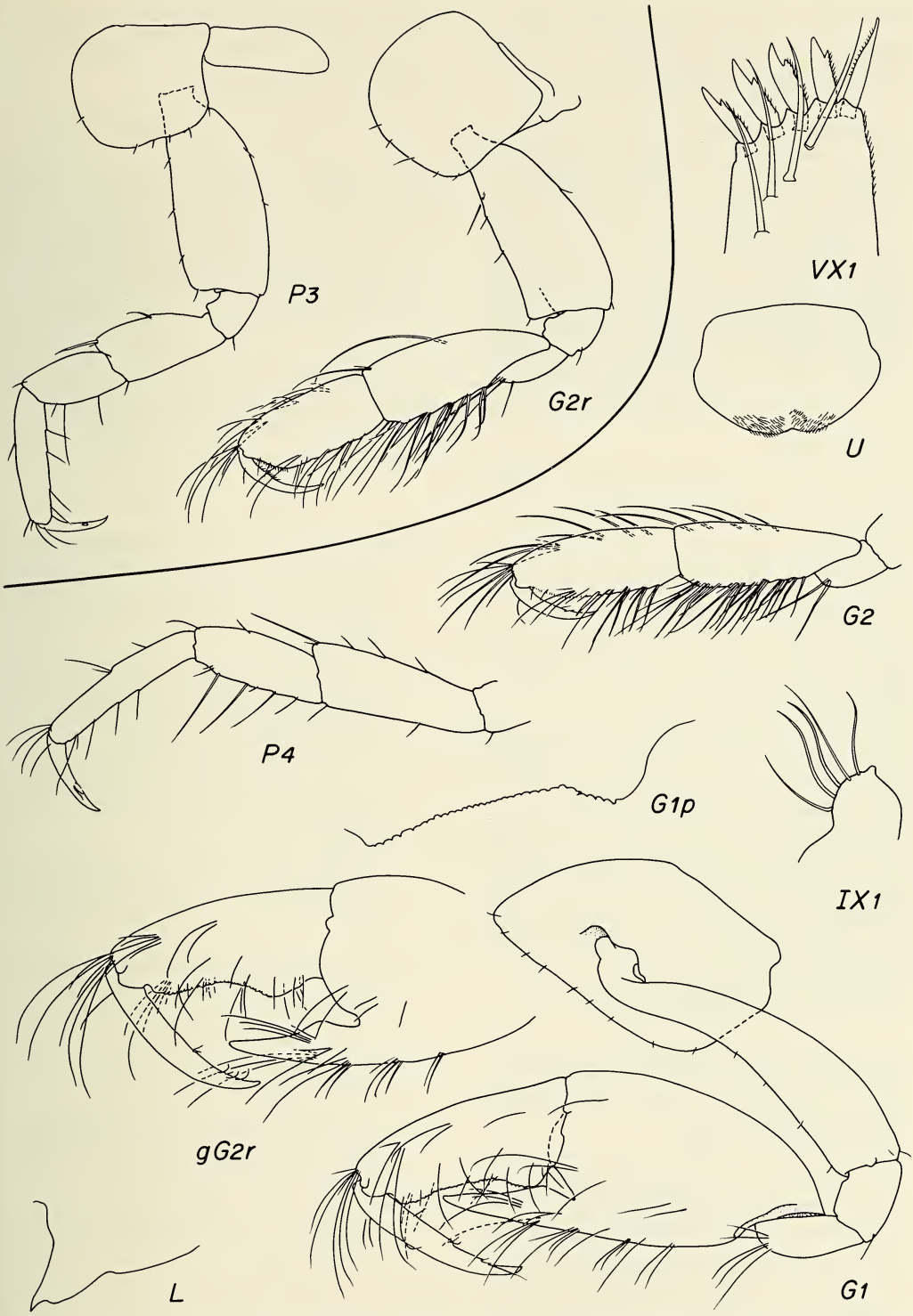

Fig. 6. Upper, *Neomegamphopus heardi,* holotype, male "c" 1.99 mm. Lower, *N. kalanii,* holotype male "r" 2.99 mm; g = male "g" 2.78 mm.

groove for reception of carpus. Palm of gnathopod 2 defined by setae. Coxae 3–7 and pereopods 5–7 (see illustration of 7) like *N. hiatus*. Gill 7 vestigial.

Epimera and uropods generally as in *N. hiatus*; spine counts on lateral peduncle of uropods 1–3 = 2-1-1; lateral and medial marginal spine counts (not apical) on rami of uropods 1–2 = 1 + 1, 1 + 1, on inner rami = 0 + 1, 0 + 3 (or 1 tiny and 2 on opposite side); spines on outer and inner rami of uropod 3 = 1 and 1; ventrolateral face on peduncle of uropod 1 with 2 spines.

Male "a" 2.32 mm.—Carpus of gnathopod 2 with 2 anterior setae; mandibular palp with 4 A setae.

Etymology.—Named for Dr. Richard Heard, for his many contributions to marine biology.

Holotype.—USNM 195150 (transferred to Allan Hancock Foundation as rightful owner), male "c" 1.99 mm.

Type locality.—*Velero III* station 114-33, Bahia Honda, Panama, near east point, 2 fms, 10 Mar 1933.

Material.—Type locality, male "a" 2.32 mm, young male "d" 1.86 mm, young male "p" 1.52 mm, young male "q" 1.93 mm and several other probable specimens.

Relationship.—This species is very close to *N. roosevelti* from the eastern Pacific Ocean but differs in the presence of 2 teeth on the carpus of gnathopod 1 (versus 1) and the poor development of anterior setae on the carpus of gnathopod 2.

Distribution.—Pacific Panama, 4 m.

Neomegamphopus species C (Venezuela)

Neomegamphopus roosevelti.—Myers, 1968b:127–128, fig. 1.

The material of this morph, from Coche Island, Venezuela (Caribbean Sea) is like *N. heardi* in that it has an inner accessory tooth on the carpal process of male gnathopod 1 but the tooth is small, not palmate, and the propodus of gnathopod 2 is simple; the accessory flagellum is only half as long as article 1 of the primary flagellum on antenna 1, a probable character of value (but see discussion in introduction).

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(JLB) Department of Invertebrate Zoology, National Museum of Natural History, NHB-163, Smithsonian Institution, Washington, D.C. 20560; (JDT) Newfound Harbor Maine Institute, Rt. 3, Box 170, Big Pine Key, Florida 33043.